

### A.3.5 Planetary Instrument Definition and Development Program

#### 1. Scope of Program

The Planetary Instrument Definition and Development Program (PIDDP) supports the advancement of spacecraft-based instrument technology that shows promise for use in scientific investigations on future planetary missions. The goal of the program is not to develop flight-qualified hardware, but rather to define and develop scientific instruments or components of such instruments to the point where the instruments may be proposed in response to future announcements of flight opportunity without additional extensive technology development. The proposed instrument technology must address specific scientific objectives of candidate future missions. New measurement concepts can be proposed, as well as methods to significantly improve the performance of existing instruments and/or the development of technologies that enable integrated instrument packaging (architectures). The emphasis in this NRA is also on the development of miniaturized, low power, low cost instruments for Discovery-class and other similar missions.

Instrument definition and development studies can take place at several stages, from feasibility studies, to conceptual design, to laboratory breadboarding (but not brassboarding) of critical components and complete instruments. Particularly for immature or very complex new instruments, proposers initially may choose to only define or develop the most risky components. However, in all cases of component only development, one or more likely scenarios for possible follow on instrument development should be described. For all (instrument or component) proposals, scientific objectives of those instruments (or proposed follow on instruments), and future candidate missions should be discussed in the proposal. Proposed instruments must address significant scientific questions relevant to stated NASA goals.

Results of PIDDP work have contributed to the eventual development of flight hardware flown on or selected for many NASA missions. Since this is the goal of the PIDDP program, proposals should consider the potential of the proposed effort for enhancing future technology validation and science missions. This NRA also solicits proposals for instrument concepts addressing goals of NASA's Astrobiology Program. Spacecraft instrument development activities that were previously funded under the Exobiology Research and Analysis Program are now included exclusively in the PIDDP.

Proposals not appropriate for this NRA are those that seek to develop laboratory instruments, ground-based or airborne telescopes, auxiliary instrumentation such as spectrometers for telescopes, onboard data processing or data compression studies, or any spacecraft technology that does not directly address science instrumentation.

While this program element will be advertised annually, the nature of specific efforts selected for funding will vary, with emphasis in any given year placed on preparation for the nearest term missions for which instruments have not yet been selected. However, there can also be support provided for long lead-time definition studies, for innovative approaches that may provide entirely new classes of instruments, for the development of new enabling technology for missions farther in the future, and/or for detector development studies that may advance the technology for a wide range of planetary instrumentation applications. Therefore, proposers are encouraged to relate their proposed efforts as closely as possible to specific future planetary missions and demonstrate how their technology addresses the scientific goals of these missions.

## 2. PIDDP-Focused Future Missions

Proposals for instrument definition and development for certain of the following future missions will be considered for funding through the PIDDP.

### • *Discovery Program*

The Discovery Program is envisaged as a series of focused, quick-turnaround missions. Development time will be approximately 36 months, and launch vehicles will not be larger than a Delta-II. The first Discovery missions, the Near Earth Asteroid Rendezvous (NEAR), Mars Pathfinder, and Lunar Prospector have been launched, and Stardust is scheduled to be launched in February 1999. CONTOUR and Genesis were selected in 1997, and five new missions were selected for Phase A study in November 1998 (final mission selection is scheduled for the spring of 1999). Future solicitations are planned approximately every 18 months.

The Discovery missions may include flyby, orbiter, lander, Earth orbiting telescopes, and sample return missions to a variety of solar system objects to study surface and atmospheric composition, thermal structure, meteorology, geoscience, topography, dynamics, and field and particle environments. Instrumentation and techniques addressing critical scientific questions in this broad range are appropriate development efforts under the PIDDP. Technology applicable to multiple missions and investigations will have higher priority for funding. However, instrument definition and development will be considered only for missions that follow NEAR, Mars Pathfinder, Lunar Prospector, Stardust, CONTOUR, and the missions selected in 1999. Proposals for the development of new instruments for missions already selected for Discovery Phase A study and/or development will not be accepted under this NRA.

- *Mars Surveyor Missions*

The Mars Surveyor missions include orbiters and landers that utilize small to medium spacecraft. The first of these are the Mars Global Surveyor, launched in November 1996, and the Mars Climate Orbiter and Mars Polar Lander, launched in December 1998, and January 1999. U.S. science instruments for the Mars Surveyor 2001 orbiter and lander missions and for the Mars Surveyor 2003 missions have already been selected. Future launches to Mars will occur approximately every 26 months. Scientific payloads will consist of small, lightweight, low power consumption instruments.

Instrument development proposals for both U.S. and international follow-on missions to Mars (i.e., beyond the Mars 2003 mission) are appropriate under this NRA. Consideration will also be given to proposals addressing the development of instrumentation for Mars sample return missions, a major focus of Mars exploration in 2003 and beyond.

Instrument technologies for the *in situ* exploration of Mars are of particular interest for future missions. The PIDDP seeks new concepts for Mars surface science, including, but not limited to, potential instruments for radiometric age-dating, soil/rock mineralogy and chemistry, water/ice detection and characterization, exobiology assessment, drilling/coring, and atmospheric analyses. Some, but not all of these, are truly new and complex instrument concepts for planetary exploration. As such, proposers may choose to initially pursue only development of the most challenging components, as long as discussion of their connection to possible future instruments and scientific objectives is clearly discussed.

- *Micromissions*

At the time of the writing of this NRA, NASA anticipates opportunities in the coming years for micromissions. These micromissions could target Mars or other inner Solar System bodies, and possibly outer Solar System bodies. *Total* science payloads will be very small in mass (estimated 5 to 30 kg depending strongly on type of mission, e.g., flyby, orbiter, or lander, and the object to be visited; the lower bound is more likely than the upper bound), as well as power and volume. Instrument definition and development relevant to these possible micromissions is considered appropriate for this PIDDP NRA.

- *Outer Solar System Missions*

Missions to the outer planets and satellites are a specific NASA objective. By the time of selection of the proposals called for under this NRA, instruments will have already been selected for a Europa Orbiter mission and a Pluto/Kuiper Express mission, so instruments for these specific missions are not appropriate under this NRA. Although no other outer planet missions are in the near term queue, additional future opportunities might include focused science missions under the Discovery Program, or entry probes for outer planet atmospheric studies, or landers, particularly for Europa. Therefore, the PIDDP solicits instrument concepts for future outer planet missions, including but not limited to Europa

landers, Jupiter or Titan probes, and comet nucleus sample returns. These missions may include flybys, orbiters, landers (e.g., Titan, Europa, or comets), or aerobots (e.g., Titan), so science instruments relevant to remote and *in situ* studies of these bodies are solicited. Instrument concepts include, but are not limited to, ice-penetrating radar sounding systems, *in situ* instruments for icy bodies, particularly Europa, including chemical and related exobiological analyses, geophysical analyses (e.g., seismic and heat flow), shallow (~10 cm) sampling techniques, and lightweight imaging systems with broad spectral range. As stated previously, because of the newness and complexity of some of these techniques, particularly under Europa-like conditions, proposers may choose initially only to define or develop the most challenging or unknown components, but connections to possible instrument follow-ons and science objectives must be discussed. Atmospheric entry probe instrument concepts, will also receive consideration.

#### • *Origins of Solar Systems*

NASA's long-range strategy includes flight missions that will follow and extend the ground-based phase of the search for planets about other stars, and several approaches for space-based platforms addressing the search for extrasolar planetary systems have been identified. Breadboard studies of technologies and instruments (consistent with the limited scope of the PIDDP) that could contribute to the space-based search for extrasolar planets are appropriate for this NRA.

### 3. Programmatic Considerations

Proposals are solicited under this NRA for instrument definition and development only for the missions or classes of missions described in Section 2 above. Therefore, all proposals submitted to PIDDP must specify:

- The mission or class of missions for which the proposed instrument is applicable. Instruments that might fly on a number of missions will be given priority over those applicable to only a single mission.
- The science objectives of the proposed instrument. The relationship between the science objectives and the instrumental capabilities must be clearly demonstrated. For those instruments applicable to many missions or capable of meeting multiple science objectives, examples of science objectives for the proposed mission or missions should be given.
- Technological advances to be pursued as an inherent element of achieving the science objectives. Proposers are also asked to identify potential mechanisms that could facilitate transfer of these technologies to other users, including the private sector, for possible application beyond the immediate one of meeting mission science objectives.

It is anticipated that the scientific payloads on all future solar system exploration missions will be limited to small, low mass, low power consumption, and low cost instruments. For this reason, only proposals for instrument definition and development satisfying these general specifications will be considered for support.

The evaluation criteria in Section 1.4 of Appendix C are fully applicable to the PIDDP, including evaluation of scientific and technical merit, uniqueness and innovation, team and institutional capabilities, and cost. In addition, however, the determination of a proposal's relevance shall also take into account the following factors:

- The extent to which the proposed instrument is applicable to multiple missions in the Solar System Exploration science theme and/or Origins of Solar System program element (see Section A.1.1 in this Appendix);
- The extent to which the instrument addresses a priority science goal of the mission or missions for which it would be a candidate for flight;
- Either the near-term nature of the mission or missions in question, or the necessity of embarking on a long lead-time development of a very important instrument contemplated for flight on a mission that is of high priority, even though it is not in the near-term queue; and
- Whether the instrument is deemed to fall within the scope of PIDDP, including whether it too developmentally mature for PIDDP.

It should be noted that the contemplated sequence of missions described in this NRA is a best current estimate and is subject to change. NASA reserves the right to make a determination of relevance based on the contemplated sequence of missions as it is understood at the time of proposal evaluation and selection.

#### 4. Proposal Submission

Full, new proposals are sought for either entirely new studies or for the extension of PIDDP studies terminating in FY 1999. Proposals may specify periods of performance of up to three years. A final report will be required at the termination of the period of performance. It is expected that there will be approximately \$3M dollars available for new (and extension) proposals, and that 12 to 18 studies will be supported with these funds.

As a modification to the default specification in Section C.5.1 of Appendix C, 17 copies of the proposal are required, including one with original signatures.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <http://props.oss.hq.nasa.gov/>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: [deb.tripp@hq.nasa.gov](mailto:deb.tripp@hq.nasa.gov)) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement  
Planetary Instrument Definition and Development Program  
Jorge Scientific Corporation  
Suite 700  
400 Virginia Avenue, SW  
Washington, DC 20024  
Phone number for commercial delivery: (202) 554-2775

Proposals previously selected for multiple year periods of performance that are continuing beyond FY 1999 require the submission of an Annual Progress Report and updated budget in order to allow processing of their annual funding allotment. Two copies should be sent to the Discipline Scientist listed below at least 90 days prior to the anniversary date of the funding instrument.

Additional information may be obtained from the Discipline Scientist:

Dr. Bruce Betts  
Research Program Management Division  
Code SR  
Office of Space Science  
NASA Headquarters  
Washington, DC 20546-0001  
Telephone: (202) 358-0297  
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